WE CLAIM:

1. A process for producing an electrically conductive noble metal thin film on a substrate in a reactor by atomic layer deposition, comprising:

placing a substrate in a reaction chamber within the reactor;

providing a vaporized noble metal precursor pulse into the reaction chamber to form no more than about a single molecular layer of the precursor on the substrate;

removing excess vaporized noble metal precursor from the reaction chamber;

providing a second reactant gas pulse comprising oxygen to the reaction chamber such that the oxygen reacts with the precursor on the substrate;

removing excess second reactant gas and any reaction by-products from the reaction chamber; and

repeating until a thin film of a desired thickness is obtained.

2. The process of Claim 1, wherein the second reactant gas comprises free oxygen.

3. The process of Claim 2, wherein the free oxygen is molecular oxygen.

4 The process of Claim 3, wherein the noble metal is selected from the group consisting of ruthenium, rhodium, palladium, silver, rhenium, osmium, iridium, platinum and gold.

5. The process of Claim 3, wherein the noble metal precursor is selected from the group consisting of a metallocene compound and a beta-diketonate compound of the noble metal.

6. The process of Claim 5, wherein the metallocene is selected from the group consisting of bis(cyclopentadienyl)-ruthenium, a derivative of bis(cyclopentadienyl)-ruthenium, (trimethyl)methylcyclopentadienylplatinum and a derivative of (trimethyl)methylcyclopentadienylplatinum.

7. The process of Claim 5, wherein the beta-diketonate compound of the metal is selected from the group consisting of tris(2,2,6,6-tetramethyl-3,5-

heptanedionato)ruthenium(III), a derivative of tris(2,2,6,6-tetramethyl-3,5-heptanedionato)ruthenium(III), bis(2,2,6,6,-tetramethyl-3,5-heptanedionato)ruthenium(II) and a derivative of bis(2,2,6,6,-tetramethyl-3,5-heptanedionato)ruthenium(II).

8. The process of Claim 3, wherein the second reactant gas is provided by pulsing oxygen into the reaction chamber.

9. The process of Claim 3, wherein the second gas reactant is provided by pulsing a mixture of oxygen and inert gas into the reaction chamber.

10. The process of Claim 3, wherein the second reactant gas is provided by the catalytic decomposition of an oxygen-containing chemical inside the reactor.

11. The process of Claim 10, wherein the oxygen-containing chemical is H_2O_2 or an organic peroxide.

12. The process of Claim 11, wherein the catalytic decomposition is carried out using a catalyst selected from the group consisting of palladium and platinum.

13. The process of Claim 3, wherein the second reactant gas is provided by forming oxygen inside the reactor by decomposing N_2O.

14. The process of Claim 3, wherein a growth initiating layer is provided on the substrate surface prior to depositing the noble metal thin film.

15. The process of Claim 14, wherein the growth initiating layer comprises hydroxyl groups.

16. The process of Claim 15, wherein the growth initiating layer is an Al_2O_3 thin film.

17. The process of claim 15, wherein the growth initiating layer is a TiO_2 thin film.

18. The process of claim 14, wherein the growth initiating layer has a thickness of between 10 Å and 20 Å.

19. The process of Claim 14, wherein the growth initiating layer is produced by feeding H_2O_2 into the reaction chamber after placing the substrate in the reaction chamber and prior to providing the vaporized noble metal precursor pulse.

20. The process of Claim 3, wherein the noble metal thin film comprises a plurality of metals selected from the group consisting of ruthenium, rhodium, palladium, silver, rhenium, osmium, iridium, platinum and gold.

21. The process of Claim 20, wherein the noble metal thin film comprises ruthenium and platinum.

22. The process of Claim 21, wherein the noble metal thin film comprises a first portion, adjacent to the substrate, consisting essentially of ruthenium, and a second portion, over the first portion, the second portion consisting essentially of platinum.

23. A process for producing a noble metal thin film on a substrate comprising:

placing a substrate in a reaction chamber;

pulsing a vaporized noble metal precursor into the reaction chamber to form an adsorbed layer of the noble metal precursor on the substrate;

removing excess vaporized noble metal precursor;

converting the adsorbed noble metal precursor layer to a noble metal layer by contacting the substrate with a gas containing oxygen;

removing excess oxygen-containing gas and any reaction by-products; and

repeating until a thin film of the desired thickness is formed.

24. The process of Claim 23, wherein the oxygen is free oxygen.

25. The process of Claim 24, wherein the oxygen is molecular oxygen.

26. A process for producing a capacitor in an integrated circuit, comprising:

depositing a first insulating layer on a silicon substrate having a doped region;

forming a conductive material contacting the substrate through the insulating layer;

depositing a barrier layer over an exposed surface of the conductive material;

depositing a first electrode layer comprising a noble metal on the barrier layer by an atomic layer deposition process;

depositing a second insulating layer on the first electrode layer; and

depositing a second electrode layer comprising a noble metal on the second insulator by an atomic layer deposition process.

27. The process of Claim 26, wherein the atomic layer deposition processes comprise alternately reacting the substrate surface with a vaporized noble metal precursor and a gas comprising oxygen.

28. The process of Claim 27, wherein the oxygen is free oxygen.

29. The process of Claim 28, wherein the oxygen is molecular oxygen.

30. The process of Claim 26, wherein the barrier layer comprises a metal nitride layer deposited by atomic layer deposition on the exposed surface of the conductive material.

31. The process of Claim 30, wherein the barrier layer comprises tantalum silicon nitride.

32. The process of Claim 26, wherein the second insulating layer comprises a layer having a high dielectric constant that is deposited by atomic layer deposition.

33. The process of Claim 32, wherein the second insulating layer comprises a layer selected from the group consisting of barium-strontium titanate and tantalum oxide.

34. A method of producing an ultra-high density magnetic recording device comprising:

forming a first ferromagnetic recording layer on a substrate;

forming by an atomic layer deposition process a non-magnetic layer consisting essentially of a noble metal on the first ferromagnetic recording layer; and

forming a second ferromagnetic recording layer on the non-magnetic layer.

35. The method of Claim 34, wherein the atomic layer deposition process comprises alternately reacting the substrate surface with a vaporized noble metal precursor and oxygen.

36. The method of Claim 35, wherein the thickness of the non-magnetic layer is between about 1 nm and 100 nm.